Completely extruded talus without soft tissue attachments

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Abstract

A completely extruded talus without any remaining soft tissue attachments is extremely rare. The present report describes treatment of a 45-year-old man who sustained a completely extruded talus injury following a rock-climbing fall. Upon admission, the extruded talus was deep-frozen in our bone bank. The open ankle joint underwent massive wound debridement and irrigation for 3 days. Four days later we performed a primary subtalar fusion between the extruded talus and the calcaneus, anticipating revascularization from the calcaneus. However, aseptic loosening and osteolysis developed around the screw and talus. At 12 months post-trauma we performed a tibiocalcaneal ankle fusion with a femoral head allograft to fill the talar defect. Follow-up at 24 months post-trauma showed the patient had midfoot motion, tibio-talar-calcaneal fusion, and was able partake in 4-hour physical activity twice per week.

Introduction

Total talar dislocation caused by high-energy injury is unusual but not uncommon.[1-14] Such dislocation is frequently associated with severe soft tissue injury, disruption of the talar blood supply and fractures of surrounding bones. However, cases involving complete extrusion of the talus without any remaining soft tissue attachments, so-called *missing talus* cases, are rare.[1,3,8,9,14] Completely extruded talus cases differ from other types of talar injury cases due to the lack of vascularity and risk of infection.

The optimal treatment for completely extruded talus has not been established. While some clinicians advocate reimplantation of the extruded bone,[1,2,9,11,12] this approach often leads to secondary procedures due to anticipated complications such as deep infection, avascular necrosis, osteoarthritis and resorption of bone.[4,8,13,15]

The present report describes treatment of a patient with a completely extruded talus. Treatment involved storage of the bone in deep-freeze and temporary ankle fixation while the wound was thoroughly debrided and irrigated over a period of days. The talus was then reimplanted. Finally tibio-talar-calcaneal fusion as secondary procedure was performed. At 2-years post-trauma the patient was able to participate in regular vigorous activity.

Case Report

A 45-year-old man was injured when rock climbing after free-falling from a height of 5 meters, and then rolling for another 15 meters. The trauma caused the talus bone to completely extrude, and it was found at the site of the fall. The talus was severely contaminated with gravel, soil and mud. The patient arrived at the emergency department 1 hour after the accident with the talus bone in his hand. He had sustained a pantalar dislocation and had a > 10 cm transverse open wound on the medial aspect of the ankle (Figure 1). He had no other major injuries. The distal senses and circulation in the injured foot were intact. Initial roentgenograms showed complete absence of the talus and a fracture of both malleoli.

He was immediately taken to the operating room. The extruded talus was thoroughly washed and deep-frozen in the bone bank. Avascular necrosis (AVN) of the talus was seemed to be inevitable based on the complete disruption of blood supply. An initial subtalar fusion was performed in the expectation of revascularization from the calcaneus. An ankle arthroplasty was planned as later surgery. We performed massive wound debridement and irrigation due to concerns of infection in the deep open wound. The unstable open ankle joint was temporarily fixed using multiple Kirschner wires without reduction of the talus. The wound underwent daily debridement and irrigation for 3 days.

Four days later, a primary subtalar fusion was performed with a reimplantation of the extruded talus using internally fixed cannulated screws. Additional reduction and fixation of the fractured medial malleolus was done (Figure 2).

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Six months post-trauma, radiographs showed osteolysis on the talus and loosening of the screws (Figure 3). We performed a curettage for the great part of the talar body, and inserted an antibiotic-impregnated cement spacer due to a suspicion of infection. However, a tissue biopsy showed granulation tissue and necrotic fibrosis of bone and marrow without significant neutrophil infiltration. Blood test results (ESR: 19, CRP: 0.15) gave no indication of infection. In addition, biopsy cultures showed no growth of any bacteria, fungus or tuberculosis in cultures. Follow-up tests showed the same results. Therefore, aseptic loosening and osteolysis had developed around inserted screw. At 12 months post-trauma, we performed a tibiocalcaneal ankle fusion with multiple screw fixations using femoral head allografts to fill the talar defect. A 24 months post-trauma, we observed midfoot motion due to the preserved talonavicular joint, and tibio-talar-calcaneal fusion (Figure 4). The patient was able to partake in 4-hour courses of tracking twice per week.

Discussion

A completely extruded talus associated with a high-energy injury is rare, and is complicated by soft tissue injuries and fractures. This injury is prone to infection, avascular necrosis, late arthritis and poor functional outcome. There is no generally agreed established treatment. Both primary talectomy and talus salvage have been recommended. Marsh *et al*. recommended primary talectomy in cases in which the talus was extruded through the wound and contaminated, indicating a high risk of infection.[15] Smith *et al*.[2] and Assal *et al*.[9] reported that a totally extruded talus should be managed with thorough cleaning and debridement of the

wound and reimplantation. If the extruded talus is available and replaced, the survival of the talus probably depends on the avoidance of infection and avascular necrosis, and the existence of residual soft tissue attachments retaining blood supply to the talus.

Some authors reported that reimplantation of the extruded talus with some retained soft tissue attachments provided relatively good clinical results.[2,5,11-13] However, in cases without any soft tissue attachments, reimplantation can be questioned due to the avascular condition and contamination of the talus, which may act as a sequestrum.

There appear to be only 10 cases of complete talus extrusion without any soft tissue attachments in 7 reports.[1-3,8,9,14,16] Reimplantations were performed in 6 of those 10 cases, and interestingly none was associated with subsequent infection or avascular necrosis, and only 4 cases developed osteoarthritis. These results appear to contradict general clinical opinion. Palamo-Traver *et al*. reported that the talus might be replaced unless it was totally extruded or grossly contaminated.[12] Hiraizumi *et al*. suggested that impairment of circulation related to trauma of the surrounding vascular and lymphatic structures lent itself to non-healing conditions, leading to subsequent infection, and thus predisposing the patient to acute and chronic bone infection.[10,14] In the present case, the talus was available albeit contaminated, and was replaced after thorough washing.

We felt that AVN of the talus was inevitable, and planned a primary subtalar fusion and revisional ankle arthroplasty. We anticipated talus revascularization from the calcaneus by initial subtalar fusion. However, in spite of union at the fusion site, periarticular osteolysis developed. We could not find a cause of the progressive periarticular osteolysis. Because we had not ruled out the possibility of low-grade infection, a tibiocalcaneal fusion was performed using a femoral head allograft after massive debridement. We predicted that immediate repositioning of the talus through the open wound may lead to infection in two stages. First, reanastomosis may not be gained by simple talus repositioning, and second, early wound closure makes it difficult to debride and clean an open wound. However, against our expectation, other authors reported that AVN and infection of the talus was rare when treatment involved early thorough irrigation and repositioning by minimal internal fixation such as K-wire fixation. A feature of the present case was bone resorption due to undetermined processes. Deep-freezing of the talus and use of a two-staged operation has been suggested to weaken bone viability and create aseptic loosening.[17] Further anatomical and physiological studies are required to better understand the reasons why completely extruded talus cases have a lower rate of AVN than talar neck or body fracture cases. The inside-out open wound of a completely extruded talus injury may have less contaminative than the other types of open wounds. Therefore, we recommend thorough early cleaning and immediate repositioning via temporary internal fixation when treating completely extruded talus cases.

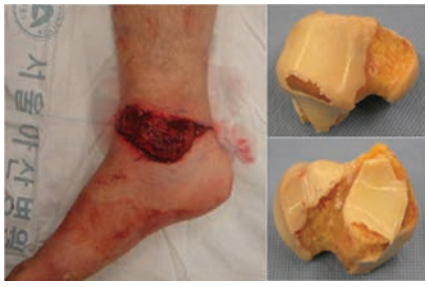

Figure 1. Photographs of the ankle and the totally extruded talus.

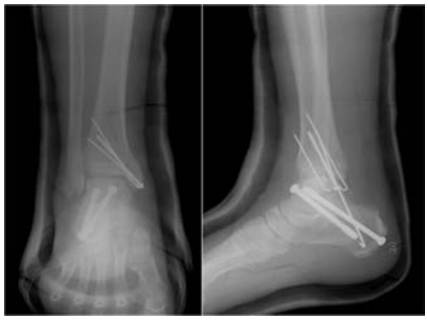

Figure 2. Postoperative radiographs after reimplantation of the talus and subtalar fusion with two screws.

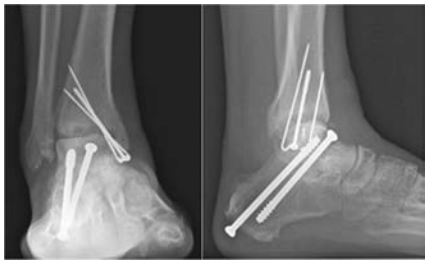

Figure 3. Radiographs of the ankle at 6 months after injury, showing osteolysis of the talus and loosening of the screws.

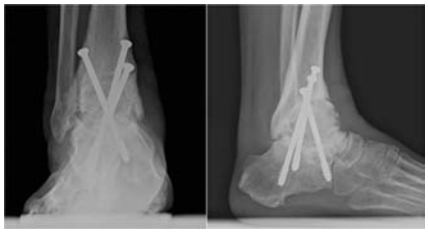

Figure 4. Radiographs of the ankle at 2 years after injury, showing solid fusion.

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